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AUTHOR Beveridge, Sandy K.; Gangstead, Sandy K.
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ABSTRACT

The relationships among teaching experience, gender, and selected factors involved in qualitative skill analysis were explored in addition to the effects of systematic analytical instruction. Prior to and after 30 hours of instruction, 31 experienced physical education teachers and 29 physical education undergraduates were administered the Utah Skills Analysis Test to assess short-term memory of performance and knowledge of correct motor patterns. A two-way ANOVA was employed to ascertain the initial effects of teaching experience and gender. Analysis of perceptual data revealed a significant main effect for gender, a notable main effect for group, and no significant group by gender interaction. Prior to training, females performed better than males, and teachers slightly better than undergraduates. Analysis of the knowledge data revealed no significant main effects or interactions. A repeated measures ANOVA was used to determine the treatment effect across group and gender. The analysis indicated significant treatment effects across groups on both perceptual and knowledge measures. Conclusions included: (1) Gender, not teaching experience, appeared to be the critical factor in the initial determination of analytical performance; and (2) Both teachers and undergraduates demonstrated the ability to improve performance in skill analysis. (Author/JMK)

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A comparative analysis of the effects of instruction on the analytical proficiency of physical education teachers and undergraduates

Sandy K. Beveridge, Ph.D.
Department of Physical Education
University of Utah
Salt Lake City, UT 84112

Sandy K. Gangstead, Ph.D.
School of HPELS
Oklahoma State University
Stillwater, OK 74078

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Abstract

The relationship between teaching experience, gender and selected factors involved in qualitative skill analysis was explored in addition to determining the effects of systematic analytical instruction. Prior to and after 30 hours of instruction, 31 experienced teachers and 29 undergraduates were administered the Utah Skills Analysis Test, a VTR format to assess both short-term memory of performance and knowledge of correct motor patterns. A two-way ANOVA was employed to ascertain the initial effects of teaching experience and gender. Analysis of perceptual data revealed a significant main effect for gender ($p \leq .001$), a notable main effect for group ($p \leq .06$), and no significant group by gender interaction. Prior to training, females performed better than males, and teachers slightly better than undergraduates. Analysis of the knowledge data revealed no significant main effects or interactions. A 2 X 2 X 2 repeated measures ANOVA was utilized to determine the treatment effect across group and gender. The analysis indicated significant treatment effects across groups on both perceptual and knowledge measures ($p < .001$). A significant main effect for group was noted ($p .05$). Undergraduates exhibited greater pre to posttest gains than teachers on both dependent variables. No significant interactions were revealed. It was concluded that (a) gender, not teaching experience appeared to be the critical factor in the initial determination of analytical performance, (b) both teachers and undergraduates demonstrated the ability to improve performance in skill analysis.

Teachers and coaches are continually involved in the processes of observation, evaluation, and interpretation of learner performance during motor skill instruction. They must identify specific movement deviations from established performance criterion, and interpret the significance of such deviations prior to offering instructional intervention. Successful completion of teachers' roles as feed back agents, in providing knowledge of results and corrective prescription, is contingent upon the accuracy of their analytical judgements.

Naked-eye observation of learner performance appears to be an essential cognitive operation upon which further interpretive operations in the analytical process rest. In order to identify critical features of a learner's response and recognize subsequent performance errors, the teacher must be able to discriminate the critical aspects of the performance from a visual field arrayed with relevant and nonrelevant movements of the body segments. The high speed and sometimes simultaneous manner in which these body segments move through space adds to the complexity of the visual display. The observational task required of teachers is further complicated by the fact that they must retain performance information after the visual stimulus has been extinguished. Thus, the tasks of visual discrimination and image retention pose perceptual problems for the teacher.

Differences in the ability of observers to perform various perceptual tasks relevent to the analytical process have been revealed in several studies. Why the differences exist, and to

what extent one can be taught the analytical process of error detection are questions still being addressed by many investigators. The role that teaching experience plays in one's ability to analyze motor skill performance is a question of particular interest. Task experience and teaching experience have both been found to account for differences in analytical performance when subjects are asked to perform visual recognition or visual retention tasks.

The present study represents, in part, a further investigation of the relationship between teaching experience and two aspects of skill diagnosis: (a) short-term visual retention of sport skill performance and (b) knowledge of correct motor patterns of those same skills.

This study also represents an attempt to ascertain to what extent gender may influence analytical performance, particularly the perceptual aspects of the analytical process. No discernable research to date has empirically supported gender as a plausable factor which may influence analytical performance.

Obvious needs exist for training paradigms which offer effective reduction in the complexities of the observational tasks confronting the teacher. Yet few investigators allude to the nature of such training. This is due in part to a lack of understanding of the processes by which teachers gain the perceptual and diagnostic competencies required in the analytical process. The supposition that specific instructional experiences can influence analysts' ability to organize the spatial and temporal aspects of movement does rest on supportive, albeit not extensive,

empirical data. Further research is warranted before judgements can be made regarding the educational significance of resultant learning gains from such instruction.

The present study is an extension of earlier work (by the authors) by investigating further the effects of similar training based upon the same observational framework. In addition to noting initial effects of teaching experience and gender on short-term retention of performance observations and knowledge of correct motor patterns, the present study was specifically designed to determine the effects of systematic instruction on the analytical performance of experienced physical education teachers and undergraduate physical education majors.

It was anticipated that experienced teachers and undergraduates would perform equally on both analytical tasks prior to training. Marginal differences were expected to favor experienced teachers particularly on the perceptual task. It was hypothesized that: (a) both groups would demonstrate improvement in performance on the perceptual task, and knowledge of correct motor patterns as a result of the treatment and (b) any differences in performance between the two groups on pretreatment to posttreatment gain would be in favor of the teachers due to greater experience in the observation and instruction of motor skills.

Method

Subjects

Sixty subjects representing two levels of teaching experience participated in the study. The experienced group was comprised of

31 secondary physical education teachers with an average of 16.1 years of teaching experience and 9.0 years of coaching experience. The average amount of personal competitive experience across all reported sports for teachers was 9.4 years. The novice groups consited of 29 undergraduate physical education majors who exhibited no full-time teaching experience, an average of 1.2 years of coaching experience and 8.5 years of personal competitive experience across all reported sports (see Table 1). Selection criteria for the experience group were: (a) full-time employment as a physical education instructor a minimum of three years, (b) a bachelors degree with physical education as an academic major, and (c) no previous experience with the specific analytical instruction utilized as the treatment other than basic kinesiology and/or biomechanics coursework completed as part of undergraduate preparation. Selection criteria for the novice group were: (a) no full-time teaching experience in physical education, (b) full-time undergraduate status with a declared major in physical education, (c) completion of undergraduate kinesiology, and no previous experience with the specific analytical instruction. Informed consent was obtained form all subjects prior to initiation of the study.

Procedures

The instructional curriculum designed to enhance the development of observational and evaluative skill analysis processes consisted of a 10-week unit presented to both groups three times a week at one hour intervals. Instructional experiences were guided

Table 1

Experiential Information of Subjects

	Teachers		Undergraduates	
	Male (11)[a]	Female (20)	Male (16)	Female (13)
Instructional Experience				
Mean Number of Years Full-time Teaching	17.9	14.11	.00	.00
Mean Number of Years Coaching	11.27	7.78	1.20	1.25
Competitive Experience				
Mean Number of Sports per Subject	2.90	2.32	2.27	2.92
Mean Number of Years Competed per Sport	3.93	3.59	3.09	3.71
Mean Total Years of Competitive Experience	11.40	8.32	7.01	10.83

[a]Numbers in parenthesis indicate the number of subjects who participated in the study.

by one university professor with expertise in teacher preparation and seven years teaching experience in sport skill analysis. Standardization of instruction was facilitated by the use of instructional videotapes which illustrated both correct and incorrect performance of selected sport skills. Skills presented for analysis were organized into common patterns of movement, e.g., overarm, underhand and sidearm throwing and striking patterns; nonsupport and suspension movements; and twisting and rotational movements. Duplicated videotapes were utilized to ensure that all subjects were exposed to identical illustrations of various learner skill attempts which served as the basis for in-class analytical exercises. All analytical exercises were conducted during the scheduled instructional time intervals in order to establish uniformity between subject in the amount of time spent for each exercise. During instruction, emphasis was continually placed upon: (a) proper description of the skill attempt which served as target for the analysis, (b) how the identified description deviated from the criterion performance previously established, and (c) prescription of prioritized instructional strategies for correction of performance errors.

A specific observational model adapted from Cooper's work was designed to facilitate the organization of the spatial and temporal components of movements, and served as the unifying framework for discussion of all analytical work. Subjects were instructed in the usage of this model during their initial observations of learners' skill attempts. Usage of the model (Figure 1) directed the subjects' attention towards the temporal aspects

of a performance. Preparation, Action, and Follow Through phases were identified for each skill under analysis. Special attention was given to: (a) movements of body segments which initiated or ended each phase, (b) the phase in which force production -as initiated towards the skill objective, and (c) the proportion of the total movement time each phase occupied. The model also suggested a general order in which subjects selectively attended to the primary body segments and their movements across the temporal phases of the skill. This particular spatial dimension of the model directed subjects' attention from the "hub" or slowest moving part of the body, progressively outward, to the motion of the extremities, often the fastest moving body segments.

Instrumentation

The Utah Skill Analysis Test (USKAT) developed by thee authors, was utilized to assess performance on both dependent variables of interest. Short-term visual retention of performance was assessed using the perceptual portion of the test which contained a series of videotaped illustration of actual learner performance on four selected sport skills. The skills viewed included the overarm throw, standing long jump, batting, and the cartwheel. Fundamental sport skills were used to control for subjects variability in skill experience and to enhance the likelihood that teachers would be experienced in teaching such skills. Four individual performances of each skill (16 total) by male and female junior high school level students were utilized in the test. Subjects viewed five trials of each performance, exactly

BODY COMPONENTS	TEMPORAL PHASING		
	PREPARATION	ACTION	FOLLOW THROUGH
PATH OF HUB			
BODY WEIGHT			
TRUNK ACTION			
HEAD ACTION			
ACTION OF LEGS			
ACTION OF ARMS			
IMPACT/RELEASE			

Figure 1 OBSERVATIONAL MODEL

reproduced, in the following sequence: (a) two sideviews, (b) two front views, and (c) another sideview. Front and sideviews were the same performance of the learner. Subjects viewed a performance sequence and then were allowed to read and respond to written movement description relevant to the particular performance. The response format (Figure 2) required subjects to report the presence or absence of specific movement phenomemon in each performance viewed. Knowledge of correct motor patterns was assessed utilizing the same movement descriptions as items categorized under each skill. Subjects were asked to determine whether each movement described should occur in a correct performance of the designated skill.

Data Collection and Analysis

The perceptual and knowledge components of the USKAT were administered to subjects prior to the initiation of the instructional program. The testing area consisted of a regular classroom furnished with five 19 inch colored video monitors connected to one master VHS video tape recorder. Subjects were seated in front of each monitor at a distance of between four to six feet. The total duration time of the perceptual component was approximately 25 minutes. Subjects were allowed a five minute rest period prior to administration of the knowledge component of the test. A total of 46 responses were solicited from each subject on each portion of the USKAT. Subjects were administered the USKAT in the same manner at the conclusion of the instructional experience.

Subject H: Cartwheel

Item #	Movement Description	Movement Observed?	
23.	The hands are placed on the floor at the same time.	Yes	No
24.	The distance between the hand and foot contact points on the floor are evenly spaced.	Yes	No
25.	The body is upright and balanced, with arms stretched overhead at the completion of the cartwheel.	Yes	No

Figure 2. USKAT Perceptual Test Response Format

To determine the initial effects of teaching experience and gender on perceptual performance and knowledge of correct motor patters and the overall effect of the treatment across group and gender, 2 (group) X 2 (gender)) X 2 (pretest-posttest) ANOVA's with repeated measures on the last factor were employed on performance data for each dependent variable. The criterion level for this and all other statistical tests performed was $P < .05$.

Results

Mean performance scores on each dependent variable are reported in Table 2. The analysis of the pretreatment perceptual scores revealed a significant main effect for gender, and a notable, but not statistically significant main effect for group, and no significant group by gender interaction (Table 3). A comparison of mean scores between males and females showed that female subjects scored significantly higher on the perceptual component of the USKAT prior to training than male subjects. Inspection of mean scores between teachers and undergraduates revealed teachers performed slightly but not significantly better than undergraduates prior to administration of the treatment. The ANOVA on pretreatment knowledge scores (Table 4) indicated no significant main effects for group or gender, and no significant group by gender interaction prior to training.

When looking at the effect of treatment, (see Figures 3-4) a comparison of sample means revealed a significant pre to posttest gain in perceptual performance for the entire sample. A groups by pretest-posttest interaction, was noted, although not statistically

Table 2

Mean Performance Scores and Standard Deviations for Analytical Tests and Subscales

		Teachers				Undergraduates			
		Male		Female		Male		Female	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Perceptual Total (46)[a]	$\bar{X}$	30.55	33.82	34.55	35.65	30.50	34.50	32.00	35.23
	SD	2.73	3.37	2.74	2.48	2.39	2.80	3.37	3.00
Over arm Throw (11)	$\bar{X}$	7.09	8.27	8.75	8.25	7.38	7.88	7.31	7.62
	SD	1.45	1.90	1.33	1.33	1.26	1.54	1.89	1.71
Standing Long Jump (13)	$\bar{X}$	8.45	8.82	9.05	9.90	8.05	10.00	9.62	10.08
	SD	2.16	1.17	1.67	1.55	1.26	1.59	1.39	1.38
Batting (12)	$\bar{X}$	7.91	8.73	8.45	9.00	8.00	8.56	7.62	9.31
	SD	1.45	1.10	1.47	1.56	1.26	1.59	1.39	1.38
Cartwheel (10)	$\bar{X}$	7.00	7.82	8.25	8.60	6.63	8.13	7.46	8.31
	SD	1.41	1.60	1.16	1.05	1.36	1.36	1.27	.95
Knowledge Total (46)	$\bar{X}$	35.46	38.00	37.70	38.65	36.00	38.38	35.77	39.54
	SD	2.34	2.45	2.92	2.39	2.78	1.93	3.77	2.18
Overarm Throw (11)	$\bar{X}$	8.64	8.36	8.65	8.55	7.63	8.56	8.23	9.23
	SD	1.69	1.69	1.39	1.39	1.26	1.09	1.42	.83
Standing Long Jump (13)	$\bar{X}$	9.27	10.55	10.25	10.40	10.44	10.63	9.31	10.15
	SD	1.19	.82	1.59	1.50	1.55	1.45	2.02	1.63
Batting (12)	$\bar{X}$	9.36	11.00	9.60	10.70	9.44	10.88	9.46	10.85
	SD	1.21	1.18	1.17	1.21	.81	1.27	.69	
Cartwheel (10)	$\bar{X}$	8.45	8.09	8.95	8.90	8.44	8.38	8.69	9.31
	SD	1.37	.83	1.10	.85	1.26	.89	1.18	.63

[a]Numbers in parentheses indicate the maximum score possible.

Table 3

2 (group) X 2 (gender) ANOVA
Pretreatment Perceptual Data

Source	SS.	DF	MS	F(1,56)
Main Effects	164.930	2	82.465	10.50*
Group	28.869	1	28.869	3.68
Sex	107.568	1	107.568	13.70*
Two-Way Interaction				
Group X Sex	22.376	1	22.376	2.85
Explained	187.306	3	62.435	7.952*
Residual	439.677	56	7.851	
Total	626.983	59	10.627	

*p<.001

Table 4

2 (group) X 2 (gender) ANOVA
Pretreatment Knowledge Data

Source	SS.	DF	MS	F(1,56)
Main Effects	29.018	2	14.509	1.615
Group	11.454	1	11.454	1.275
Sex	11.825	1	11.825	1.316
Two-Way Interaction				
Group X Sex	18.779	1	18.779	2.090
Explained	47.797	3	15.932	1.774
Residual	503.053	56	8.983	
Total	505.850	59	9.336	

*p<.05

significant with $p \leq .05$ as the criterion level. Undergraduates tended to exhibit greater pre to posttest gains than teachers. No significant gender by pretest-posttest interaction was revealed. Also no significant group by gender by pretest-posttest interaction was noted on perceptual performance.

The ANOVA employed to analyze the knowledge data indicated a significant treatment effect across subjects, and a signifiant group by pretest-posttest interaction (Figures 5-6). As in the analysis of the perceptual data, a comparison of sample means indicated a significant pre to posttest gain in knowledge of correct motor patterns for the entire sample (Table 6). Further inspection of group means revealed that undergraduates exhibited greater pre to posttest gains than teachers. However, no significant gender by pretest-posttest interaction, was noted. No significant three-way group by gender by pretest-posttest interaction, was revealed.

Discussion

Results indicating that female teachers and undergraduates were better at remembering details of motor performance than both male groups prior to instruction conforms with trends previously noted by the authors in undergraduate performance on similar recognition tasks. Research reveals few patent explanations as to why female subjects would perform better than male subjects on the perceptual task. Is the difference a function of differential teaching experience in the particular skills of interest (female teachers were highest scorers as a group on the perceptual task), or a function of unique difference in perceptual abilities? A

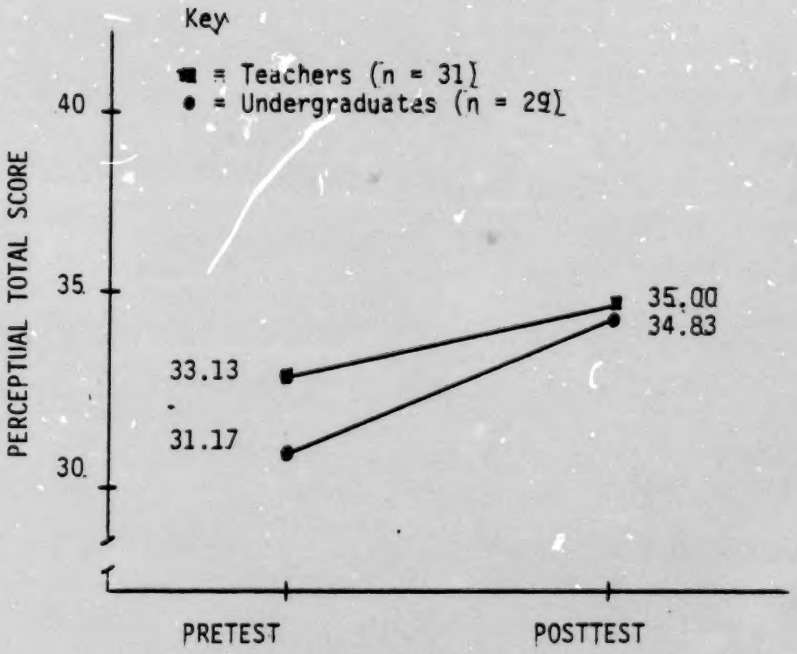

Figure 3 - Perceptual performance as a function of group and treatment

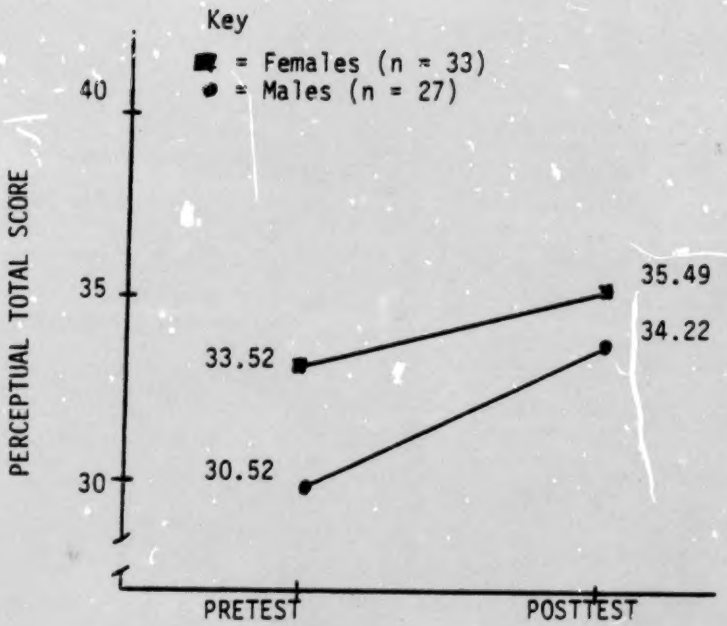

Figure 4 - Perceptual performance as a function of gender and treatment

Table 5

2 X 2 X 2 ANOVA (Group x Sex x Pretest-Postest)
Perceptual Data

Source	SS.	DF	MS	F(1.56)
Pretest-Postest	224.133	1	224.133	35.44*
Group x Pre-Post	23.849	1	23.849	3.77
Sex x Pre-Post	15.360	1	15.360	2.43
Group x Sex x Pre-Post	3.513	1	3.513	.56
With Cell (Error)	345.145	56	6.324	

*p<.001

Table 6

2 X 2 X 2 ANOVA (Group x Sex x Pretest-Posttest)
Knowledge Data

Source	SS.	DF	MS	F(1.56)
Pretest-Postest	145.200	1	145.200	32.68*
Group x Pre-Post	17.961	1	17.961	4.04
Sex x Pre-Post	.000	1	.000	.00
Group x Sex x Pre-Post	14.062	1	14.062	3.17
Within Cell (Error)	248.777	56	4.442	

*p<.05

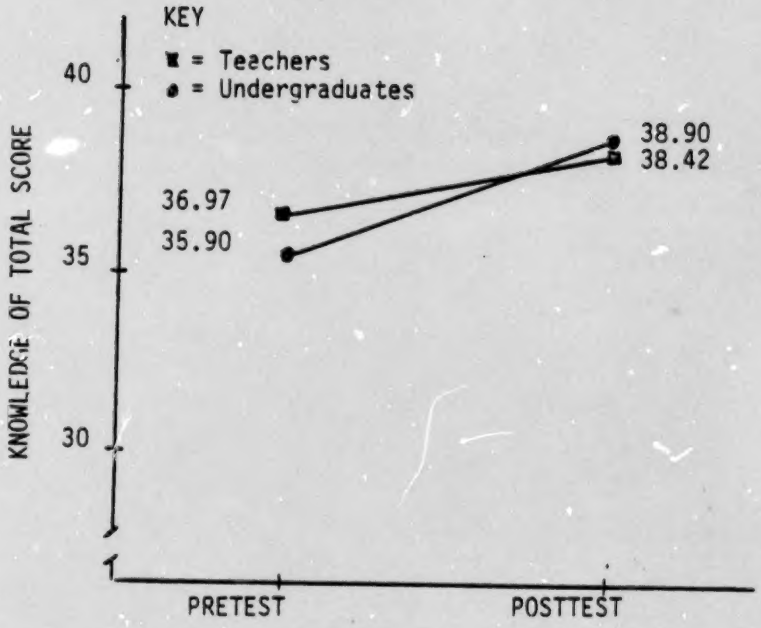

Figure 5 - Knowledge of correct motor patterns as a function of group and treatment

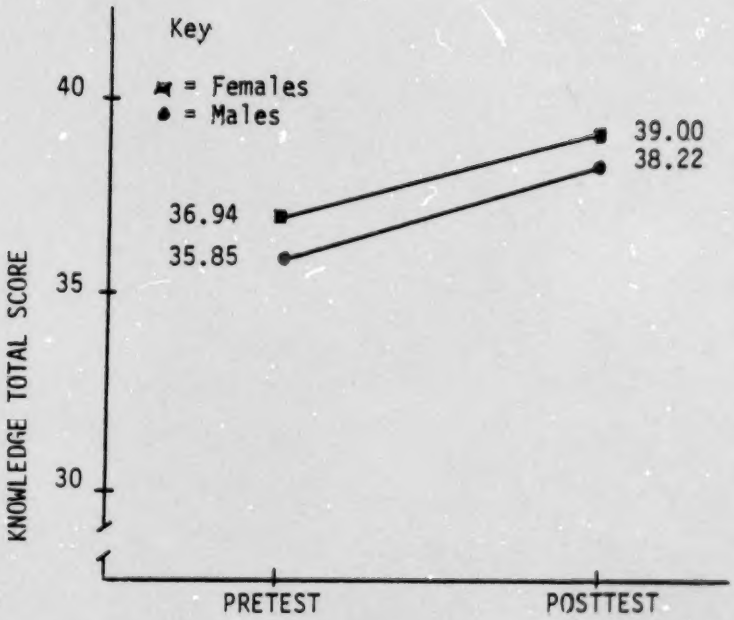

Figure 6 - Knowledge of correct motor patterns as a function of gender and treatment

plausible explanation may be that female teachers were more actively involved in the instruction of the fundamental skills used in the assessment than their male colleagues. The investigators observed more expressed interest in skills development in the physical education setting as reported by female subjects (both teachers and undergraduates) than from male subjects.

Results from the pretreatment analysis of perceptual data neither substantiate nor strongly contradict previous studies which showed teachers and undergraduates performing equally on recognition tasks of specific sport skills. When teachers were asked to remember movement phenomena of sport skills they actively observe on a daily basis in their respective instructional setting, they performed slightly better than undergraduates. The margin of accuracy between teachers' performance on the task (72% accuracy) and undergraduates' performance (68% accuracy) was similar to margins reported between experienced and inexperienced tennis teachers. Although relatively small, the differences between groups did favor experienced teachers as anticipated. Such pretreatment findings are indicative of the complexity of the observational process required in skill analysis and reinforce the need for training paradigms which may enhance perceptual performance.

Significant treatment effects across both groups tended to support the notion that analytical skills may be augmented through systematic instructional experiences. Although statistically significant, an average gain of 7% accuracy on the perceptual and knowledge tasks on the part of subjects suggested only modest gains in the anticipated direction. Given the trend of results

utilizing this generic observational model and training paradigm, speculation exists as to whether greater gains in perceptual performance would be observed if the observational format was used in instructional experiences specifically designed for the analysis of sport skills specific to a given sport, and the assessment subsequently required analysis of those sport skills. Further research is warranted before the efficacy of the observational model as an instructional tool for inservice training in undergraduate programs can be fully evaluated. It was hypothesized that differences in pre to posttreatment gains exhibited between groups would be in favor of the teachers. Results indicated just the opposite was true. Undergraduate exhibited greater gains than teachers on both analytical tasks. Perhaps the undergraduates responded more favorable to treatment as a group because they were more accustomed to classroom routines and the general academic environment necessarily imposed by the very nature of the treatment experience. Undergraduates appeared much more receptive to the introduction of the observational model used in the in-class analysis exercises. Undergraduates may have also been ore accustomed to the usage of video equipment. The results of this study lend support to those in teacher preparation programs who feel that skill analysis as a teaching competency should be assessed and subsequent relevant training attempted in the development of such competencies. The following conclusions seem warranted:

1. The evidence is inconclusive as to the effects of teaching experience on perceptual analytical ability.

2. Analytical skills may be augmented through systematic instructional experience.

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